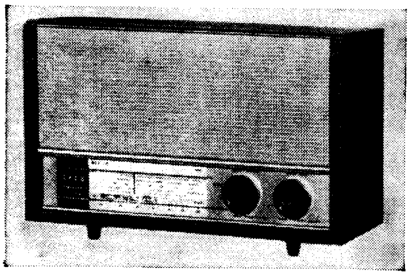
"TRADER" SERVICE SHEET
1482

EKCO BT359

A.M./F.M. Transistorized Table Receiver



Appearance of the Ekco BT359.

SEPARATE A.M. and F.M. receivers are used as far as the detector stages in the Ekco BT359, but with one exception the same transistors are used in both circuits, those in the I.F. amplifiers being switched. The receiver uses altogether eight transistors and operates on M.W. and in the F.M. Band II. It is housed in a table cabinet with an 8×5in speaker which is driven from a push-pull output stage with up to 500mW. The M.W. range is 188-566m.

Release date and original price: December 1960, £21 9s 3d. Purchase tax extra.

TRANSISTOR ANALYSIS

Transistor voltages given in the table below are those quoted by the manufacturer. They are negative values and they were measured on the low-voltage range of 20,000 ohms-per-volt meter whose positive lead was connected to the common positive battery line. The receiver was switched to F.M., and it was operating with a new 9V battery.

Transistor Table

Transistor	Collector (V)	Base (V)	Emitter (V)
VT1 OC171	7·2	1·7	0·95
VT2 OC170	6·0	1·2	0·96
VT3 OC170	6·0	1·2	0·9
VT4 OC170	6·0	1·2	0·9
VT5 OC71	5·0	0·75	0·7
VT6 OC81-D	8·8	1·4	1·5
VT7 OC81§	9·0	1·5	†
VT8 OC81§	9·0	1·5	†

§*VT7 and VT8 are a matched pair.*
†*No reading quoted.*

CIRCUIT DESCRIPTION

Two quite separate receiving circuits are employed for A.M. and F.M. reception, each going up to the detector stage. After that a common A.F. amplifier is used, the A.F. output from the detector circuit of the receiver in use being passed to the common volume control.

Three transistors, **VT2**, **VT3** and **VT4** are used in the A.M. receiver, and the diode **MR2**, and then four more in the A.F. stages. Four transistors, **VT1**, **VT2**, **VT3** and **VT4** are used in the F.M. receiver, and the two discriminator diodes **MR3**, **MR4**, and of course then the same four transistors in the A.F. stages.

The three transistors in the oscillator and I.F. stages of the A.M. receiver are the same three as are used in the I.F. stages of the F.M. receiver, and they are switched over to A.M. or F.M. by the waveband switch.

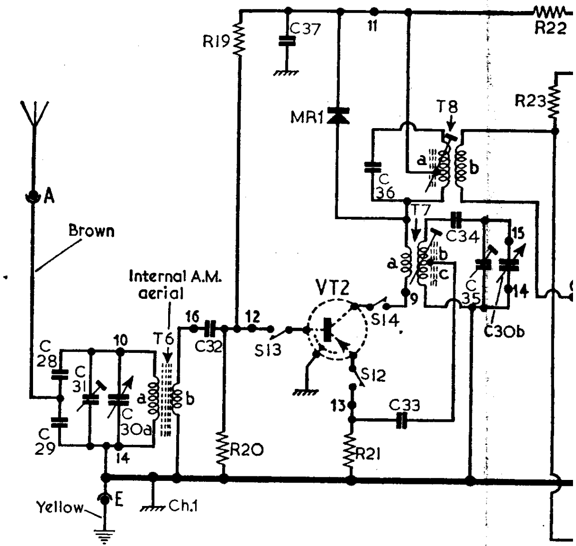
In our circuit diagram the same three transistors are shown in both A.M. and F.M. receivers, because that makes the circuit easier to read. They are connected by the closing of the switches on their emitter, base and collector leads in either circuit, and it must be understood that although no connection is shown between, say, **S1**, **S2**, **S3** and **S12**, **S13**, **S14**, actually they form three opposite pairs of single-pole two-way switches whose common points are joined to the transistor "electrode" leads.

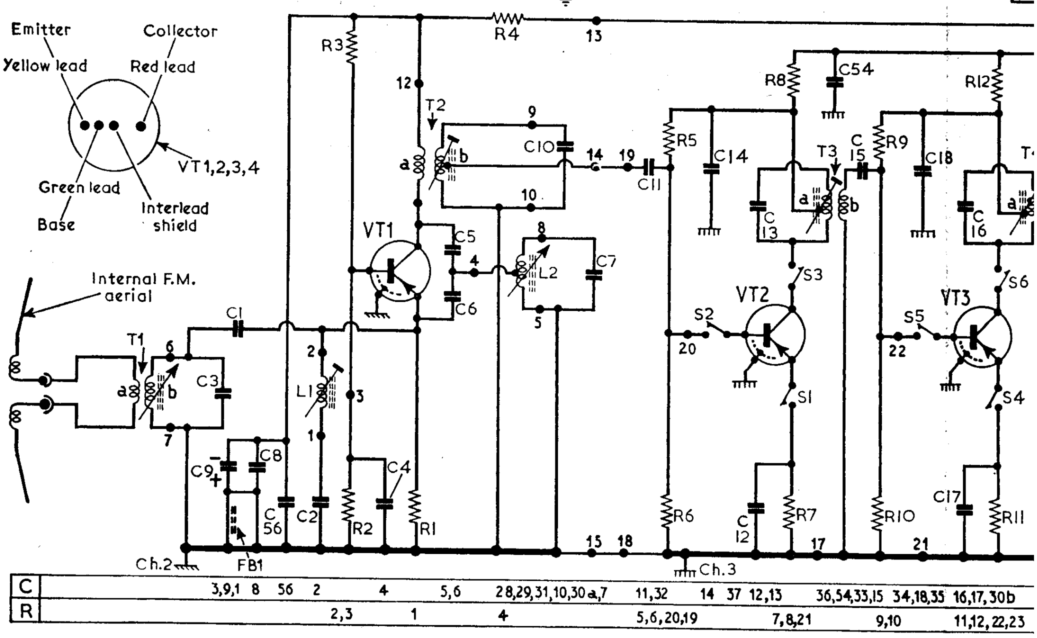
Intermediate frequencies: A.M., 470kc/s; F.M., 10.7Mc/s. When the waveband switch is in the F.M. position, all the switches from **S1** to **S9** close, and **VT2**, **VT3** and **VT4** are connected in the (lower) I.F. amplifier in the F.M. section of our circuit diagram. Aerial input from **T1** is passed via I.F. rejector **L1**, **C2** to **VT1**, which operates as self-oscillating mixer, whose output is applied to the I.F. amplifier.

S11 closes also, and the A.F. output from the ratio detector circuit (diodes **MR3**, **MR4**) is passed via the volume control to I.F. amplifier **VT5** and driver stage **VT6** which drives the push-pull output stage **VT7**, **VT8**.

When the waveband switch is in the A.M. Position, switches **S12** to **S20** close, and **VT2**, **VT3** and **VT4** are connected in the (upper) A.M. I.F. amplifier circuit, but **VT2** then operates as the self-oscillating mixer. A.F. output from detector diode

(*Continued overleaf, col. 1*)





Circuit diagram of the Ekco BT359. The manufacturers' component numbers are printed on the printed circuit aerial and I.F. amplifier stages are independent (except three transistors) and those following switches **S10**, **S11** *Transistors* **VT2**, **VT3** *and* **VT4** *are drawn twice; once dotted. They are moun*

Resistors

R1	560Ω	E4
R2	1·5kΩ	E4
R3	6·8kΩ	E4
R4	680Ω	E4
R5	10kΩ	B2
R6	2·7kΩ	B2
R7	1kΩ	B2
R8	1·2kΩ	B2
R9	10kΩ	C2
R10	2·7kΩ	C2
R11	1kΩ	B2
R12	1·2kΩ	C2
R13	10kΩ	C2
R14	2·7kΩ	C2
R15	1·2kΩ	C2
R16	150Ω	D2
R17	22kΩ	D2
R18	22kΩ	D2
R19	6·8kΩ	C2
R20	1·2kΩ	C2
R21	1kΩ	B2
R22	1·2kΩ	C1
R23	120kΩ	C1
R24	18kΩ	C1
R25	1·2kΩ	C1
R26	10kΩ	C1
R27	2·7kΩ	C2
R28	1·2kΩ	C1
R29	1·5kΩ	D2
R30	68kΩ	B3
R31	10kΩ	B3
R32	10kΩ	B3
R33	1kΩ	B3
R34	3·9kΩ	B3
R35	47kΩ	B3
R36	12kΩ	B3
R37	680Ω	C3
R38	220kΩ	C3
R39	39Ω	C3
R40	2·2kΩ	C3
R41	3·3Ω	D3
R42	270Ω	C3
R43	100kΩ	C2
R44	1kΩ	C2
R45	220Ω	C3
R46	1kΩ	C2
R47	1kΩ	C2
R48	25kΩ	A2
R49	25kΩ	A2

Capacitors

C1	6·8pF	E4
C2	220pF	E4
C3	12pF	E4
C4	0·001μF	E4
C5	68pF	E4
C6	5pF	E4
C7	18pF	E4
C8	0·04μF	E4
C9	100μF	E4
C10	68pF	E4
C11	0·001μF	B2
C12	0·01μF	B2
C13	39pF	B2
C14	0·04μF	B2
C15	0·001μF	C2
C16	39pF	C2
C17	0·01μF	C2
C18	0·04μF	C2
C19	0·001μF	C2
C20	0·01μF	C2
C21	30pF	C2
C22	0·04μF	C2
C23	39pF	C2
C24	0·001μF	D2
C25	0·001μF	D2
C26	0·01μF	D2
C27	10μF	D2
C28	3pF	C1
C29	12pF	B1
C30a	—	A1
C30b	—	A1
C31	40pF	B1
C32	0·01μF	B2
C33	0·01μF	B2
C34	450pF	B2
C35	40pF	B2
C36	250pF	C2
C37	0·04μF	C2
C38	8μF	C2
C39	0·04μF	C2
C40	250pF	C2
C41	0·04μF	C2
C42	0·04μF	C2
C43	0·04μF	C2
C44	0·04μF	D1
C45	250pF	D2
C46	0·01μF	D2
C47	0·01μF	D2
C48	8μF	B3
C49	100μF	B3
C50	100μF	C3
C51	0·1μF	C3
C52	100μF	B3
C53	500μF	D3
C54	0·04μF	C2
C55	8μF	B3
C56	0·002μF	E4
C57	0·04μF	A2

Coils*

L1	—	E5
L2	—	E5
L3	2·75	—

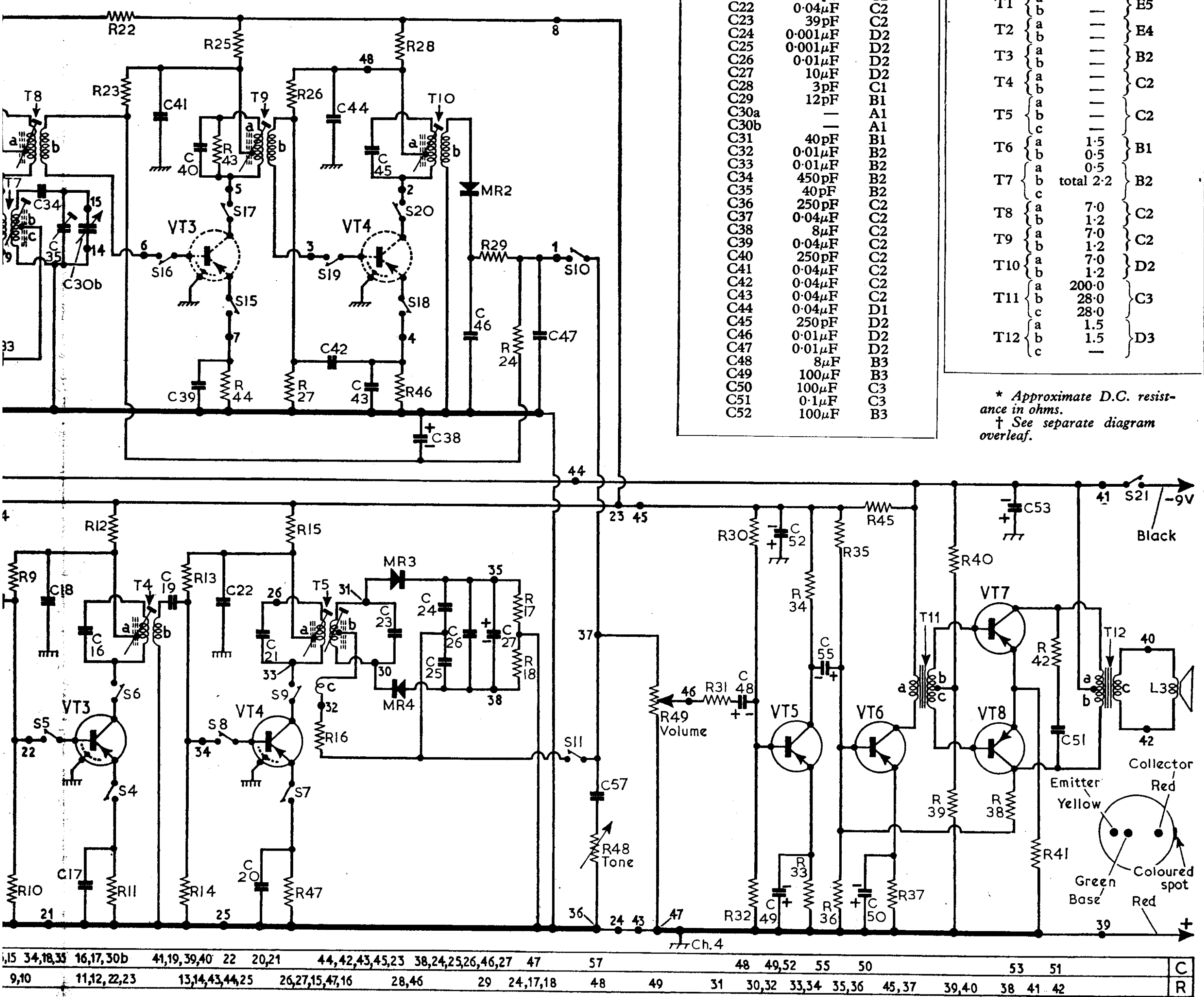
Miscellaneous

MR1	OA70	C2
MR2	OA79	D1
MR3	OA79	D2
MR4	OA79	D2
FB1	—	E4
S1, S2	—	†B2
S3-S8	—	†C2
S9-S11	—	†D2
S21	—	A2

Transformers*

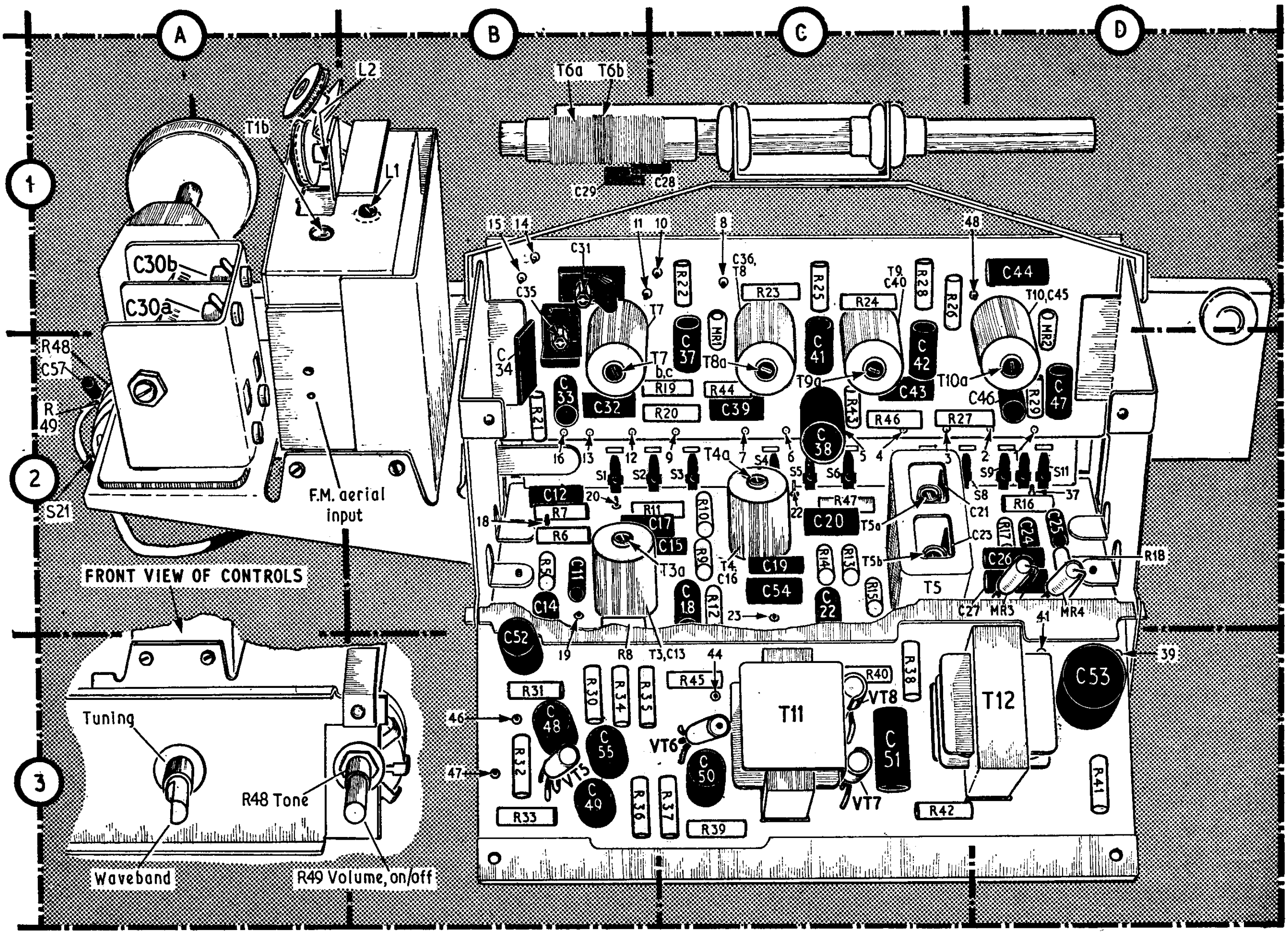
T1	a	—	E5
	b	—	
T2	a	—	E4
	b	—	
T3	a	—	B2
	b	—	
T4	a	—	C2
	b	—	
T5	a	—	C2
	b	—	
	c	—	
T6	a	1·5	B1
	b	0·5	
T7	a	0·5	B2
	b	total 2·2	
	c		
T8	a	7·0	C2
	b	1·2	
T9	a	7·0	C2
	b	1·2	
T10	a	7·0	D2
	b	1·2	
T11	a	200·0	C3
	b	28·0	
	c	28·0	
T12	a	1.5	D3
	b	1.5	
	c	—	

* *Approximate D.C. resistance in ohms.*
† *See separate diagram overleaf.*



the printed circuit panels and have therefore been used in our diagram. A key is provivided at the foot. The circuit is so designed that the A.M. and F.M. switches **S10, S11** *are common. The lower part of the diagram shows the complete F.M. circuit. Above this is the independent part of the A.M. circuit. d. They are mounted on the switch unit and connected to either the A.M. or the F.M. section by means of the switches.*

Supplement to Wireless & Electrical Trader, 21 January 1961



View of the chassis as seen from the rear with the back panel of the box-like assembly swung outwards. The inner edge of this back panel is shown cut away. The internal aerial has been moved from its position to give a clear view of the components. A front view of the controls is inset in location A3.

Circuit Description—*continued*

MR2 is passed via **S10,** which also closes, to the volume control and thus to the A.F. amplifier.

GENERAL NOTES

Switches.—S1-S20 are the waveband switches ganged in a slide-type unit running the length of the chassis. The three transistors that are involved in the A.M./F.M. switching are mounted actually on the moving contact strip, and they move with it. Their leads are soldered directly to the moving switch contacts, as shown in the diagram (top of cols. 4 & 5).

When the strip is moved to the left in our diagram, for A.M. operation, switches **S12, S13, S14,** etc., close; when it is moved to the right, for F.M. operation, switches **S1, S2, S3,** etc., close. This is very obvious from the diagram.

Transistors.—The three transistors that are used in both the A.M. and the F.M. I.F. amplifiers are mounted on the waveband switch slider, and move with it. In common with all the other transistors in the receiver their connecting leads are colour-coded with sleeving: yellow for emitter, green for base, and red for collector. Their interlead shield lead is also sleeved in yellow, but it is of a slightly larger diameter and comes from the side of the cap, not the bottom. That of **VT1** is brown instead of yellow.

Chassis Construction.—The main section of the chassis comprises three printed circuit panels, assembled on to endplates to form an open-topped box. The bottom one is the F.M. I.F. panel, the front one is the A.M. I.F. panel, and the rear one is the A.F. panel.

Our illustration of the main chassis shows all three panels. It is drawn as seen when viewed from the rear, with the rear panel, which is hinged, let down, so that the three sides of the inside of the box are visible.

The ferrite rod aerial is shown above the panels, actually a little further back than it normally is to avoid obstructing the view of the panels. The A.M. tuning gang is on a bracket on the extreme left of our drawing, and the F.M. aerial input unit is next to it.

Battery.—Suitable 9V batteries are Ever Ready PP10, Vidor 6010, Drydex DT10.

DISMANTLING

Removing Chassis.—Remove two screws at the top of the back cover, pull off the A and E connectors inside the cover and lift the cover clear;

Unhook the spring of the strap holding the battery and remove the battery;

Pull off the control knobs and pull out the F.M. aerial plug; remove four screws from under the cabinet; withdraw the chassis to the extent of the aerial leads.

The three main printed panels form three sides of a box-like assembly. To gain access to the component sides of the panels, remove two screws from the top corners of the rear side of the assembly and swing the rear panel outwards.

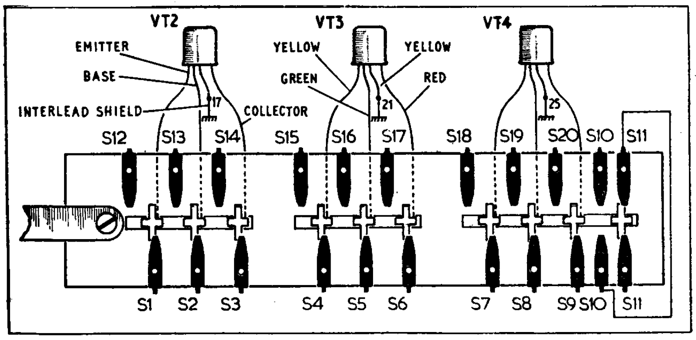
The F.M. tuner has a small printed circuit panel fitted together with its variable tuning system and enclosed in a screening box which is open at the top to receive it. Two screws on the right-hand side hold the box and tuner together and the complete assembly is held in the chassis by four screws, two in front and two behind.

CIRCUIT ALIGNMENT

Instructions are given for both visual (wobbulator) and meter methods of alignment for the I.F. amplifier of the F.M. receiver. Different equipment is required for each method, of course, and the requirements are explained at the beginning of each section. This applies also to the A.M. alignment that follows it.

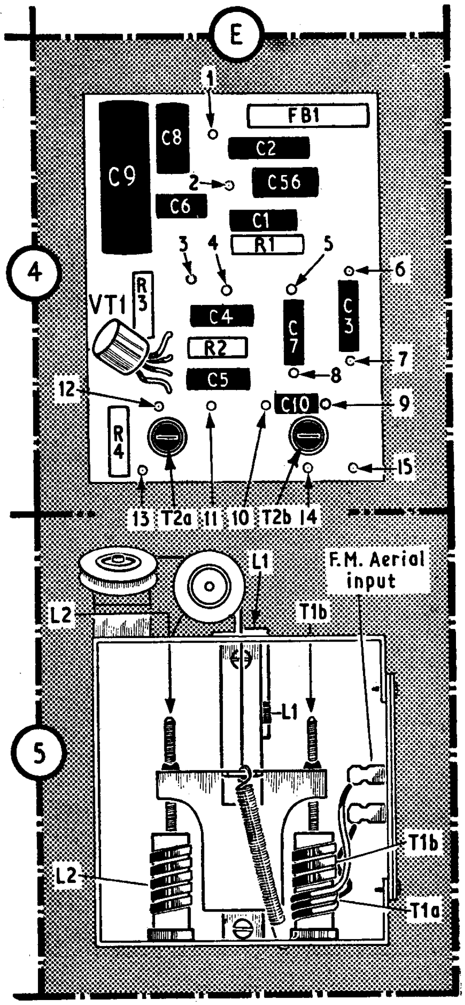
F.M. Receiver

Wobbulator method.—Switch receiver to F.M., tune it to the low frequency end of the band, and turn volume and tone controls fully anti-clockwise. Connect the oscilloscope Y leads across **R18** and disconnect one end of **C27.** In addition to the wobbu-



Left: *Diagram of the switch unit. Transistors are connected to the moving contacts as shown.*

Right: *Two views of the tuner unit as seen from the right of the chassis.*



lator equipment for the I.F. stages, an A.F. output meter or a 0-2.5V A.C. voltmeter will be required for alignment of the R.F. and oscillator stages.

1.—Connect wobbulated signal generator output to **VT4** base and chassis, feed in a 10.7Mc/s signal, and adjust the core of **T5** primary (C2), then its secondary, for maximum output.

2.—Transfer signal generator leads to **VT3** base, and adjust core of **T4** (C2) for a level response over a range of 200kc/s, properly centred so that it is level for 100kc/s either side of 10.7Mc/s, within the limit of −3dB (two-thirds of maximum) at the extremes.

3.—Transfer oscilloscope, connecting one lead to the junction of **R16** and winding **c** on **T5** and the other to chassis. Reconnect **C27**, then adjust **T5** secondary core for the best S-shaped waveform, readjusting the primary core if necessary to improve the waveform.

4.—Disconnect **C27** again, and return oscilloscope leads to **R18.** Transfer signal generator leads to **VT2** base, and adjust the core of **T3** (B2) to obtain the same waveform as in operation 3.

5.—Transfer signal generator leads to **VT1** base and adjust the cores of **T2** (E4) for the same response again as in operation 3.

6.—Transfer signal generator leads to F.M. dipole sockets and, while still feeding in a 10.7Mc/s signal, adjust **L1** (B1) for minimum output.

This completes the wobbulated alignment of the F.M. I.F. amplifier. The R.F. and oscillator adjustments are the same for either the wobbulated or spot-frequency method, and are explained in next column.

Meter method.—In addition to a standard A.M./F.M. signal generator, two indicating instruments and two matched 100kΩ resistors are required. One instrument is a 0-50μA meter, and the other may be an output meter or a 0-2.5V A.C. voltmeter.

Switch receiver to F.M., tune it to the low frequency end of the band, and turn the volume and tone controls fully anticlockwise. Connect the two 100kΩ resistors in series, then connect their free ends to the outer ends of **R17, R18.** Connect the microammeter between the junction of the two 100kΩ resistors and chassis.

1.—Connect the F.M. signal generator output to **VT4** base and chassis, feed in an F.M. signal of 10.7Mc/s, and adjust the core of **T5** primary (C2) for peak output on the microammeter.

2.—Transfer the chassis microammeter lead from chassis to the junction of winding **c** on **T5** and **R16,** then adjust the secondary core until a zero reading is obtained on the meter. Swing the core in both directions and ensure that the current swings with it from one polarity to another, then reset it accurately to zero.

3.—Return the microammeter lead to chassis. Transfer signal generator lead to **VT3** base, and adjust the core of **T4** (C2) for maximum output.

4.—Transfer signal generator lead to **VT2** base, and adjust the core of **T3** (B2) for maximum output. Readjust the cores of **T4** and **T5** primary for peak output reading.

5.—Transfer signal generator leads to **VT1** base, and adjust the core of **T2** primary (E4) for maximum output.

6.—Recheck adjustment of **T5** primary, **T4** and **T3** cores to ensure that peak output is obtained.

F.M. R.F. Stages.—Connect the output indicating instrument to the speech coil circuit, and turn the volume and tone controls fully clockwise. Adjust the input to produce just under 50mW output, and reduce it as the circuits come into line so as not to exceed 50mW (0.5V on voltmeter.

Connect the signal generator output to the F.M. dipole sockets. Tune to 92Mc/s mark on scale, feed in a 92Mc/s F.M. signal, and adjust **L2** core (E5) for maximum output to ensure accurate calibration, and then readjust **T2** core for maximum output.

A.M. Receiver

I.F. stages.—Switch receiver to M.W., tune it to a quiet spot at about 500m (600kc/s), and turn both volume and tone controls fully clockwise. Disconnect speech coil and replace it with the output meter with a 3Ω load; or alternatively, if the voltmeter is used, leave the speech coil connected and connect the meter across it. Two 0.1μF isolating capacitors will be required.

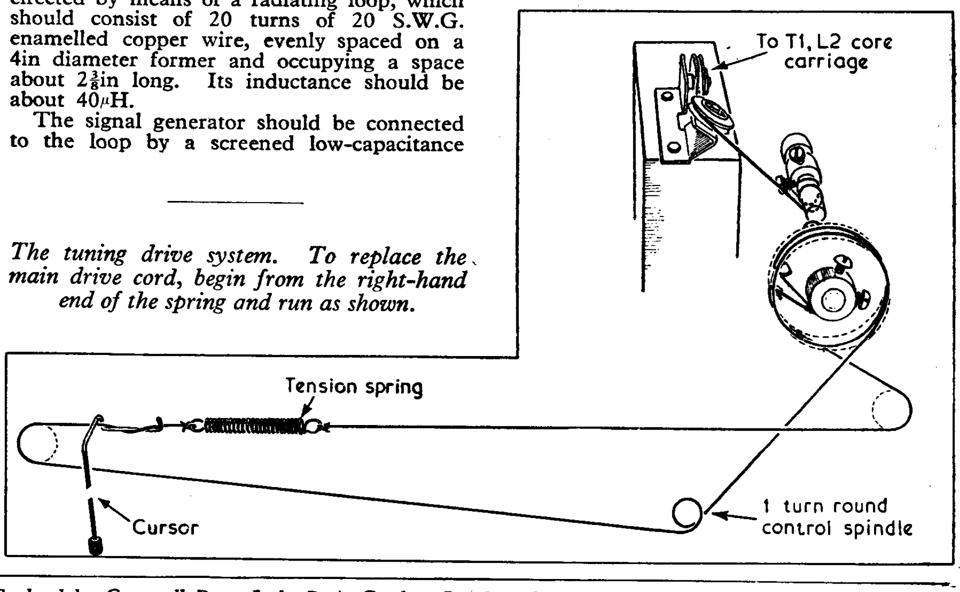
Connect the signal generator output, via a 0.1μF capacitor in each lead, across the primary winding of **T6** (B1). Feed in a 30 per cent amplitude modulated signal of 470kc/s and adjust the cores of **T10, T9** and **T8** (C2, D2) for maximum output, reducing the input signal as the circuits come into line to avoid exceeding an output of 50mW (0.5V on voltmeter). Repeat these adjustments until no further improvement can be obtained.

R.F. stages.—Coupling to the receiver is effected by means of a radiating loop, which should consist of 20 turns of 20 S.W.G. enamelled copper wire, evenly spaced on a 4in diameter former and occupying a space about 2⅜in long. Its inductance should be about 40μH.

The signal generator should be connected to the loop by a screened low-capacitance cable, and the loop should be located about 15in from the centre of the ferrite rod and should be concentric with it.

The aerial coils on the ferrite rod are accurately adjusted at the factory and then sealed, and they should not require readjustment unless the rod is replaced.

Tune the receiver to 500m on scale, feed in a 600kc/s signal to the loop, and adjust **T7** core (B2) for maximum output, then adjust **T6** (B1) on its core if that is necessary.



The tuning drive system. To replace the main drive cord, begin from the right-hand end of the spring and run as shown.